

What is claimed is:

1 1. A method for closed loop power control in a wireless communication
2 network, comprising:
3 despreading a received signal;
4 estimating the signal power of the despread received signal;
5 estimating the noise power of the despread received signal, estimating the
6 noise power including:
7 multiplying the despread received signal with an orthogonal noise code
8 to cancel the received signal; and
9 accumulating the multiplied despread received signal over one frame;
10 determining a signal-to-noise ratio of the received signal at least in part by
11 dividing the estimated signal power by the estimated noise power; and
12 determining a reverse power control bit based on the determined signal-to-
13 noise ratio.

1 2. The method according to Claim 1, wherein the determined reverse
2 power control bit corresponds to a power down command if the determined signal-to-
3 noise ratio is above a predetermined threshold and wherein the determined reverse
4 power control bit corresponds to a power up command if the determined signal-to-
5 noise ratio is not above the predetermined threshold.

1 3. The method according to Claim 1, wherein the orthogonal noise code is
2 a Walsh code.

1 4. The method according to Claim 3, wherein the Walsh code is a thirty-
2 two bit code in which the most significant sixteen bits are ones and the least
3 significant sixteen bits are zeros.

1 5. The method according to Claim 1, wherein the despread received signal
2 is arranged as a plurality of Rake fingers, and wherein estimating the signal power of
3 the despread received signal is comprised of:

4 obtaining a forward power control bit by decoding the despread received
5 signal;

6 for each of the plurality of Rake fingers:

7 multiplying the decoded forward power control bit with at least one
8 forward power control bit portion;

9 determining the position of the reverse power control bit;

10 selecting the despread received signal of the corresponding Rake finger
11 for a duration of one power control group;

12 accumulating the received despread signal to eliminate all data channel
13 signals except a pilot signal to create a decimated pilot signal;

14 multiplying the decimated pilot signal with a complex conjugate of a
15 delayed version of the decimated pilot signal to obtain a multiplied result;

16 accumulating a real component of the multiplied result over one power
17 control group to obtain a Rake finger output; and
18 determining the signal power estimate by coherently combining and averaging
19 the plurality of Rake finger outputs.

1 6. The method according to Claim 2, further comprising puncturing the
2 determined reverse power control bit into power control group data corresponding to
3 a power control group.

4 7. The method according to Claim 6, wherein puncturing the determined
5 reverse power control bit comprises:

6 buffering control group data corresponding to a plurality of power control
7 groups, the determined reverse power control bit being punctured into each of the
8 power control group data corresponding to the plurality of power control groups; and

9 updating the buffered control group data each time a reverse power control bit
10 is determined.

1 8. The method according to Claim 7, wherein the reverse power control bit
2 is determined two times per power control group.

1 9. The method according to Claim 6, wherein puncturing the determined
2 reverse power control bit comprises:

3 using a first quantity of symbols in each power control group to determine a
 4 first signal power estimate;
 5 determining a first power control bit based on the first signal power estimate;
 6 puncturing the first power control bit into the $n+2$ power control group
 7 wherein n corresponds to a predetermined power control group;
 8 using a second quantity of symbols in each power control group to determine a
 9 second signal power estimate;
 10 determining a second power control bit based on the second signal power
 11 estimate; and
 12 replacing the punctured first power control bit with the second power control
 13 bit if a power control bit position in the $n+2$ power control group is after the second
 14 quantity of symbols in a current reverse link power control group.

1 10. The method according to Claim 9, wherein the first quantity of symbols
 2 corresponds to a first four symbols in a power control group and wherein the second
 3 quantity of symbols corresponds to six symbols in the power control group.

1 11. The method according to Claim 10, wherein the symbols are Walsh
 2 symbols.

1 12. The method according to Claim 11, wherein the punctured power
 2 control bit is determined two times per power control group.

1 13. The method according to Claim 1, wherein the despread received signal
2 is arranged as a plurality of Rake fingers, and wherein estimating the signal power of
3 the despread received signal is comprised of:

4 for each of the plurality of Rake fingers:

5 coherently accumulating the despread received signal;

6 taking a squared amplitude over a time of the coherent accumulation to
7 determine a finger signal power level within one-half of a power control group;

8 summing the finger signal power levels for all of the plurality of Rake fingers
9 together over one-half of the power control group to determine an intermediate signal
10 power estimate; and

11 adding the intermediate signal power estimate to a previous signal power
12 estimate.

1 14. The method according to Claim 13, wherein the despread received
2 signal includes a non-gated pilot signal.

1 15. The method according to Claim 1, wherein the despread received signal
2 is arranged as a plurality of Rake fingers, and wherein estimating the signal power of
3 the despread received signal is comprised of:

4 obtaining a forward power control bit by decoding the despread received
5 signal;

for each of the plurality of Rake fingers:
 multiplying the decoded forward power control bit with at least one
 forward power control bit portion;
 determining the position of the reverse power control bit;
 selecting the despread received signal of the corresponding Rake finger
 for a duration of one-half power control group;
 accumulating the received despread signal to eliminate all data channel
 signals except a pilot signal to create a decimated pilot signal;
 multiplying the decimated pilot signal with a complex conjugate of a
 delayed version of the decimated pilot signal to obtain a multiplied result;
 accumulating a real component of the multiplied result over one-half
 power control group to obtain a finger signal power level;
 summing the finger signal power levels for all of the plurality of Rake fingers
 together over one-half of the power control group to determine an intermediate signal
 power estimate; and
 adding the intermediate signal power estimate to a previous signal power
 estimate.

16. A method for estimating a power level for a despread wireless
 communication signal having a non-gated pilot signal, the despread received signal
 being arranged as a plurality of Rake fingers, the method comprised of:

obtaining a forward power control bit by decoding the despread received
signal;
for each of the plurality of Rake fingers:
multiplying the decoded forward power control bit with at least one
forward power control bit portion;
determining the position of the reverse power control bit;
selecting the despread received signal of the corresponding Rake finger
for a duration of one power control group;
accumulating the received despread signal to eliminate all data channel
signals except a pilot signal to create a decimated pilot signal;
multiplying the decimated pilot signal with a complex conjugate of a
delayed version of the decimated pilot signal to obtain a multiplied result;
accumulating a real component of the multiplied result over one power
control group to obtain a Rake finger output; and
determining the signal power estimate by coherently combining and averaging
the plurality of Rake finger outputs.

17. A method for estimating a power level for a despread wireless
communication signal having a gated pilot signal, the despread received signal being
arranged as a plurality of Rake fingers, the method comprised of:
for each of the plurality of Rake fingers:
coherently accumulating the despread received signal;

6 taking a squared amplitude over a time of the coherent accumulation to
7 determine a finger signal power level within one-half of a power control group;
8 summing the finger signal power levels for all of the plurality of Rake fingers
9 together over one-half of the power control group to determine an intermediate signal
10 power estimate; and
11 adding the intermediate signal power estimate to a previous signal power
12 estimate.

1 18. A system for closed loop power control in a wireless communication
2 network, comprising:

3 a communication unit having:

4 a receiver, the receiver receiving a first signal;

5 a central processing unit, the central processing unit in operative
6 communication with the receiver and executing functions including:

7 despread the received first signal;

8 estimating the signal power of the despread received first signal;

9 estimating the noise power of the despread received first signal,

10 estimating the noise power including:

11 multiplying the despread received signal with an
12 orthogonal noise code to cancel the received first signal; and

13 accumulating the multiplied despread received first signal
14 over one frame;

15 determining a signal-to-noise ratio of the received first signal at
16 least in part by dividing the estimated signal power by the estimated noise power; and
17 determining a reverse power control bit based on the determined
18 signal-to-noise ratio.

1 19. The system according to Claim 18, wherein the central processing unit
2 further performs the function of punching the determined reverse power control bit
3 into a second signal.

20. The system according to Claim 19, further including a device, wherein
the communication unit further includes a transmitter in operative communication
with the central processing unit, the transmitter transmitting the second signal to the
device using the wireless communication network.

1 21. The system according to Claim 18, wherein the determined reverse
2 power control bit corresponds to a power down command if the determined signal-to-
3 noise ratio is above a predetermined threshold and wherein the determined reverse
4 power control bit corresponds to a power up command if the determined signal-to-
5 noise ratio is not above the predetermined threshold.

1 22. The system according to Claim 18, wherein the orthogonal noise code is
2 a Walsh code.

1 23. The system according to Claim 22, wherein the Walsh code is a thirty-
2 two bit code in which the most significant sixteen bits are ones and the least
3 significant sixteen bits are zeros.

1 24. The system according to Claim 18, wherein the despread received first
2 signal is arranged as a plurality of Rake fingers, and wherein estimating the signal
3 power of the despread received first signal is comprised of:

4 obtaining a forward power control bit by decoding the despread received first
5 signal;

6 for each of the plurality of Rake fingers:

7 multiplying the decoded forward power control bit with at least one
8 forward power control bit portion;

9 determining the position of the reverse power control bit;

10 selecting the despread received signal of the corresponding Rake finger
11 for a duration of one power control group;

12 accumulating the received despread signal to eliminate all data channel
13 signals except a pilot signal to create a decimated pilot signal;

14 multiplying the decimated pilot signal with a complex conjugate of a
15 delayed version of the decimated pilot signal to obtain a multiplied result;

16 accumulating a real component of the multiplied result over one power
17 control group to obtain a Rake finger output; and

18 determining the signal power estimate by coherently combining and averaging
19 the plurality of Rake finger outputs.

1 25. The system according to Claim 21, wherein the central processing unit
2 further executes the function of puncturing the determined reverse power control bit
3 into power control group data corresponding to a power control group.

1 26. The system according to Claim 25, wherein puncturing the determined
reverse power control bit comprises:

2 buffering control group data corresponding to a plurality of power control
3 groups, the determined reverse power control bit being punctured into each of the
4 power control group data corresponding to the plurality of power control groups; and
5 updating the buffered control group data each time a reverse power control bit
6 is determined.
7

1 27. The system according to Claim 26, wherein the reverse power control
2 bit is determined two times per power control group.

1 28. The system according to Claim 25, wherein puncturing the determined
2 reverse power control bit comprises:

3 using a first quantity of symbols in each power control group to determine a
4 first signal power estimate;

5 determining a first power control bit based on the first signal power estimate;

6 puncturing the first power control bit into the $n+2$ power control group
7 wherein n corresponds to a predetermined power control group;
8 using a second quantity of symbols in each power control group to determine a
9 second signal power estimate;
10 determining a second power control bit based on the second signal power
11 estimate; and
12 replacing the punctured first power control bit with the second power control
13 bit if a power control bit position in the $n+2$ power control group is after the second
14 quantity of symbols in a current reverse link power control group.

29. The system according to Claim 28, wherein the first quantity of symbols
2 corresponds to a first four symbols in a power control group and wherein the second
3 quantity of symbols corresponds to six symbols in the power control group.

1 30. The system according to Claim 29, wherein the symbols are Walsh
2 symbols.

1 31. The system according to Claim 30, wherein the punctured power control
2 bit is determined two times per power control group.

1 32. The system according to Claim 18, wherein the despread received first
2 signal is arranged as a plurality of Rake fingers, and wherein estimating the signal
3 power of the despread received first signal is comprised of:

4 for each of the plurality of Rake fingers:
5 coherently accumulating the despread received first signal;
6 taking a squared amplitude over a time of the coherent accumulation to
7 determine a finger signal power level within one-half of a power control group;
8 summing the finger signal power levels for all of the plurality of Rake fingers
9 together over one-half of the power control group to determine an intermediate signal
10 power estimate; and
11 adding the intermediate signal power estimate to a previous signal power
12 estimate.

33. The system according to Claim 32, wherein the despread received first
1 signal includes a non-gated pilot signal.

34. The system according to Claim 18, wherein the despread received first
2 signal is arranged as a plurality of Rake fingers, and wherein estimating the signal
3 power of the despread received first signal is comprised of:

4 obtaining a forward power control bit by decoding the despread received first
5 signal;

6 for each of the plurality of Rake fingers:

7 multiplying the decoded forward power control bit with at least one
8 forward power control bit portion;

9 determining the position of the reverse power control bit;

selecting the despread received first signal of the corresponding Rake
finger for a duration of one-half power control group;

accumulating the received despread first signal to eliminate all data
channel signals except a pilot signal to create a decimated pilot signal;

multiplying the decimated pilot signal with a complex conjugate of a
delayed version of the decimated pilot signal to obtain a multiplied result;

accumulating a real component of the multiplied result over one-half
power control group to obtain a finger signal power level;

summing the finger signal power levels for all of the plurality of Rake fingers
together over one-half of the power control group to determine an intermediate signal
power estimate; and

adding the intermediate signal power estimate to a previous signal power
estimate.